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CUSTOMIZING VEHICLE CONTROL BY INTEGRATING ELECTRONIC CONTROL UNIT SIGNAL FROM MULTI-POINT VEHICLES

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ABSTRACT

In the field of Automobile, Electronic Control Unit (ECU) plays vital role to control and monitor various parts of the vehicle. As a step ahead, in this paper we attempted to do research based on integrating discrete ECUs of multiple vehicles. The main idea behind integrating discrete ECUs is that to control vehicle in its domain and to protect from future accident caused by other vehicles in same lane. This integration is done by using RFM12B Universal ISM Band FSK Transceiver which isredefinedin ECU module. The transceiver in the ECU of the idle vehicle would transmit signal about the previous speed of the vehicle and also related to the distance of the hurdle before it at which it stopped. Meanwhile it will also receive the signal of the moving vehicle which is based on the present speed of the running vehicle and the output is in the form of voice coded signal which is given to the infotainment system in the vehicle. In the case, when the driver fails to control the speed of the running vehicle then, the driver would send an automatic alert signal which is obtained when the particular range of transmission of signal increases from the idle vehicle. This system is researched based on multiple low cost vehicles but in the case of hybrid vehicles along with previous speed of the immobile vehicle, idle state of the engine is also transmitted.

KEYWORDS: RFM12B, Electronics Control Unit, Voice Coded Signal, FSK, ISM

INTRODUCTION

The purpose of this research is to overcome accidents occurred between the vehicle which is immobile and moving vehicle. To achieve this we involved fields like communication, electronics and automobile. The main role is played by a transceiver called RFM12B which transmits and receives the data between the vehicles. It is similar to communication between two vehicles. This would avoid accidents in the case when a vehicle is stopped at a particular distance before a hurdle (like blog of tree, pit, broken bridge, etc) then the upcoming vehicles also gets alerted if at all the vehicle is not fitted with any prescribed sensors to calculate distance or simply low end model vehicles.

REQUIREMENT

Hardware Requirement

- MPC555
- RFM12B
- Relay
- Infotainment System

Software Requirement

- EMBEDDED C

- Code Warrior

Field Requirement

- Embedded Systems
- Automobile
- Communication

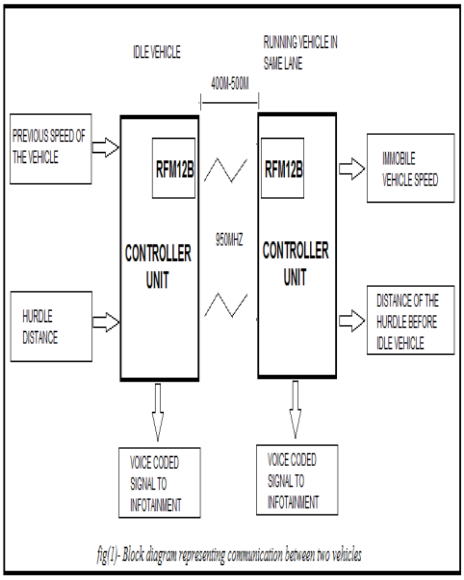

Figure 1: Block Diagram of the Controllerand Transceiver Unit

The following are the devices or peripherals attached to the microcontroller and the specification for why it is beginning used here.

MPC555 Microcontroller

The MPC555 microcontroller is a 32-bit which has 18 channels and it is one of the advanced microcontrollers used in the automobile field. Its performance is about 52.7kmps at 40MHz and one of the main advantages is that on-chip emulation development interface. The controller can support about nine general purpose input and output pins.The main purpose of using MPC555 microcontroller is that it has 2 CAN 2.0B controller modules using which each module we can receive or transmit up to 16 message buffers of 0 to 8 bytes data length.

This can enable the controller to fetch initial value conditions from different ECU's which might include speed sensor, radar, lidar, etc to fetch the speed of the vehicle which was came to rest from after detecting the hurdle in the form of the wood blog, pits, or any other natural or man-made disturbances on the lane in which the vehicle was travelling. When the other vehicle comes in the same lane and if RFM12B transceiver notices the signal from other control unit of the vehicle behind to it then based on the time in which the frequency travels is manipulated.

RFM12B Universal ISM Band FSK Transceiver

The RFM12B is a single chip low power cost transceiver and its programmable transmitter frequency is about 15 to 240 KHz along with 67 to 400 KHz of receiver band. The RFM12B has Automatic frequency control (AFC) ,Data quality detection (DQD) , Internal data filtering and clock recovery, RX synchronic pattern recognition , SPI compatible serial control interface, Clock and reset signals for microcontroller,16-bit RX Data FIFO , Two 8-bit TX data registers ,

Low power duty cycle mode , Standard 10 MHz crystal reference with on-chip tuning , Wake-up timer .2.2 to 3.8 V supply voltage , Supports very short packets (down to 3 bytes) ,Excellent temperature stability of the RF parameters and Good adjacent channel rejection/blocking.

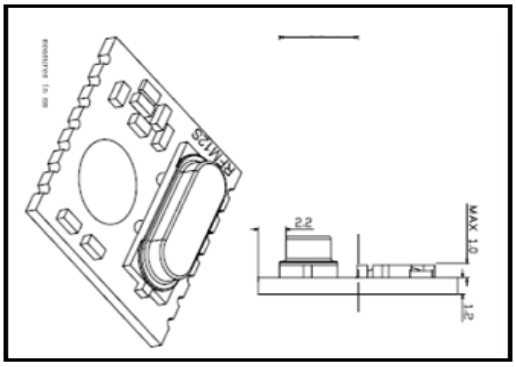

Figure 2: Cross-Sectional View of the RFM12B Universal ISM Band FSK Transceiver

Here RFM12B plays a role of detecting the speed of the moving vehicle behind the stationary vehicle by determining the time taken by the signal while transmitting and receiving the signal. The following calculations areprogrammed in the controller to analyse the speed of the upcoming vehicle in the same lane.

Frequency = 1/ Time

Speed= Distance/ Time

Sm= Dr/Tf

= 500M/ Time

Where the above speed is the speed of the moving vehicle (Sm) and this is calculated in the idle vehicle ECU. The distance between the vehicles are constant of about 500m and the signal would be transmitted and received only when the signal reaches 500m or less than that else it will not.

The idle time (Ti) of the vehicle is determined by the wait state of the speed sensor and the distance (Dh) between the hurdle in front of the idle vehicle is collected as the result information from the already installed sensor or else even from RFM12B transceiver.

Table 1: The Table Indicated Few Sample Frequencies and the Maximum Frequency in which Transceiver can Operate with

S. No	Frequency (f) (Hz)	Time(t) (Seconds)	Speed= Distance* Frequency (Km/h)
1	400Hz	2.5ms	200
2	800Hz	1.25ms	400
3	430KHz	2.3255µs	215000
4	815KHz	1.2270µs	407500
5	433MHz	2.3095ns	2.165x10^(8)
6	868MHz	1.1521ns	4.34x10^(8)
7	915MHz	1.0929ns	4.575x10^(8)

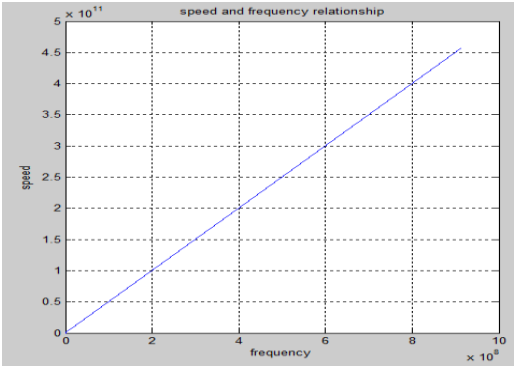

Figure 3: The Graph which Indicates that Frequency would Increase when the Speed Increases

Relay

A relay is an electrically operated switch. The function of the relays in the control unit is for controlling the movement of robot's base with respect to the on or off position of the two infrared sensors and an ultrasonic sensor. There are five "JQC-3FC (T73)" relays in which the two of it controls the left and right motion of the robots movement whereas the next two controls forward and backwardmovement. The rest one relay is used for controlling camera which is in on position only when ultrasonic sensor is on.

CAN Bus

In CAN systems a CAN node does not make use of any information about the system configuration (e.g. station addresses). This has several important consequences.

System Flexibility: Nodes can be added to the CAN network without requiring any change in the software or hardware of any node and application layer.

Message Routing: The content of a message is named by an IDENTIFIER. The IDENTIFIER does not indicate the destination of the message, but describes the meaning of the data, so that all nodes in the network are able to decide by Message Filtering whether the data is to be acted upon by them or not.

Multicast: As a consequence of the concept of Message Filtering any number of nodes can receive and simultaneously act upon the same message.

Data Consistency: Within a CAN network it is guaranteed that a message is simultaneously accepted either by all nodes or by no node. Thus data consistency of a system is achieved by the concepts of multicast and by errorhandling.

Transformers

The transformer used here is a step down transformer where the 230 v is converted into 12v. There is two such transformer which produces AC voltage where both its supply are joined together and one is connected to the four diodes whereas the other is connected for the sensor's supply, in order to operate it successfully.

Infotainment System

The infotainment system is used in order to alert driver when need a raises. In case the driver using the moving vehicle cannot control the vehicle then in that case a alert message either in the form of voice coded signal through speaker or any other infotainment system is used by which at least human in the vehicle can be safe.

OPERATION

In this research, we made an attempt to detect the speed of the vehicle by maintaining the distance between the vehicle as 500m and then noticing the time taken by the frequency to reach the receiver. If the vehicle is detected in the same lane and also within the 500m range then the RFM12B Universal ISM FSK transceiver then the signal related to the time in which the vehicle is idle and also the distance between the idle along with the distance between the hurdle before it is transmitted to the moving vehicle. The moving vehicle in turn tries to control the vehicle else the alert signal through the infotainment system is transmitted to the driver.

Algorithm

Step-1: Supply of 6v is connected to the controller unit.

Step-2: Microcontroller unit along with the RFM12B Universal ISM is active.

Step-3: Now the signal is transmitted / received in a definite pattern.

Step-4: Consider the fixed distance between the transceivers as 500m.

Step-5: In the case if the signal travelled is received by the transceiver of the other vehicle then two conditions would occur

- *If the distance between the transceivers is equal to 500m then the moving vehicle is in the alert zoneand the speed of the vehicle is calculated.*
- *Else the distance is considered to be greater than 500m.*

Step-6: Suppose the distance between the transceivers is considered as equal to 500m then continous monitoring of the distance is done using the controller unit.

Step-7: The signal received by the transceiver is calculated using the following

Frequency = 1/ Time

Speed= Distance/ Time

Sm= Dr/Tf

= 500M/ Time

Step-8: In turn the idle vehicle would transmit the signal based on the idle time (Ti) and distance between the idle vehicle and the hurdle before it (Db).

Step-9: After transmitting and receiving the signal then the two conditions would take place

- *The driver of the moving vehicle will take a need action by either stopping the vehicle or diverting it into other lane.*
- *Else the alert signal is sent through the infotainment system in idle vehicle.*

Step-10*: Stop.*

Flow Chart

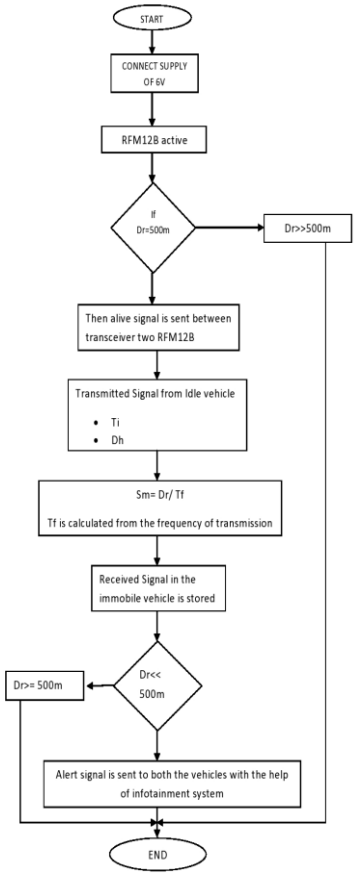

Figure 4

Output

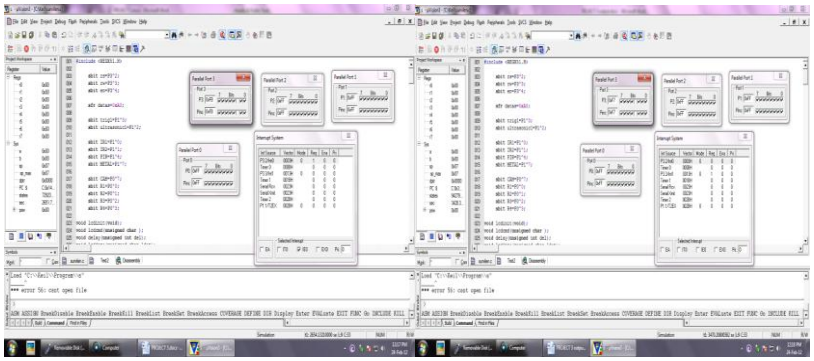

Figure 5: Output Waveform for Serialinterupt

APPLICATIONS

- The main purpose of designing this using atransceiver is to find optimal way of finding a distance between the two vehicles.
- The speed of the vehicle before and behind the idle vehicle can be found out.
- One of the model for driver assitance system as alert signal is given to the driver through infotainment systems.
- This would be helpful in terrains where sliding of rocks are more and not safe to drive.

- While parking in malls where driving slopes are there that time to be safe in the turns.

CONCLUSIONS

Thus the full paper deals with the transceiver which is used to find out the distance between the idle and the moving vehicle. This can be extended to measure speed and distance between two vehicles but we just researched keeping a standard distance and calculating speed by frequency shift key method.

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